Ophiuroidea (Echinodermata) from Carrie Bow Cay, Belize

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ABSTRACT

Thirty-six species of ophiuroids representing 16 genera in eleven families occur at Carrie Bow Cay, Belize. The rank order of abundance of species in various parts of the reef complex is estimated on the basis of numerical representation in the collection. The four most common species in the lagoon among discarded conch shells are *Ophiothrix oerstedi*, *Ophiactis savignyi*, *Ophiothrix angulata*, and *Ophiolepis paucispina*; on the reef flat are *Ophioderma appressum*, *Ophiocoma echinata*, *Ophiolepis impressa*, and *Ophiocoma wendti*; on the reef crest are *Ophiocoma wendti*, *Ophiocoma paucigranulata*, *Ophiocoma pumila* and *Ophiocoma echinata*; on the fore reef including the accessible part of the fore-reef slope are *Ophiocoma pumila*, *Ophiothrix angulata, Ophioderma rubicundum*, and *Ophiurochaeta littoralis*. Fifteen species are reported for the first time from Belize, including a new species of *Ophioderma.* All specimens of *Ophiostigma* sp. are six armed and fissiparous; they almost certainly represent a new species different from *O. isacanthum.* The occurrence of young in the bursae of *Ophiurochaeta littoralis* and *Ophiolepis paucispina* indicates but does not prove viviparity. A small amphiurid that clings mouth to mouth to an *Ophiopsila riisei* has three arms aligned and in contact with those of its host. The blue-purple color of many preserved specimens of *Ophiothrix angulata* and *O. oerstedi* is an artifact, the color in life usually being shades of brown.

Introduction

This report on the ophiuroids of Carrie Bow Cay is based on field work conducted 21 April through 9 May 1974. Carrie Bow Cay is a small island situated 22 km southeast of Dangriga (Stann Creek) (approximately 16°48′N, 88°05′W), on the barrier reef that extends along the coast of Belize (formerly British Honduras). An extensive collection of ophiuroids was made from various habitats and depths for the purpose of inventorying the species composition and distribution. The principal collecting localities categorized by major physiographic features of the reef complex are listed below. Detailed descriptions of these habitats are given by Rützler and Macintyre (herein: 9).

Thirty-six species in 16 genera and 11 families of ophiuroids are recognized in this report, including two not fully identified and one that is a new species of *Ophioderma.* All the species collected by Devaney (1974) at Turneffe Islands, Lighthouse Reef, and Glover's Reef are represented at Carrie Bow Cay except, perhaps, his *Ophioderma* sp., which I could not recognize from his description. Fifteen of the species are reported from Belize for the first time, although they have been known from other West Indian localities. Almost all species were photographed in color while alive, in order to document colors that are lost or changed with the fixatives used.

Acknowledgments.—My participation in this project was made possible by a Smithsonian Postdoctoral Fellowship (1973–1974). The field party consisted of K. Rützler, E. Kirsteuer, K. Sandved, B. Spracklin, and myself. K. Sandved took the color photographs in the field and collected many ophiuroids. The completion of this manuscript was facilitated by the assistance of J. Jonigian, M. Roberson, T. Burrows, J. Arguelles, E. Ball, D. DeJianne, A. Pruzan, and by a Short-Term

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Methods

Ophiuroids were collected at 13 stations by hand using snorkel or SCUBA, according to depth. In most cases specimens were found hidden under coral, coral rock, or dead shells, or in nooks and crannies of living coral or sponges. Bulk samples of substrate for sorting ashore were collected from stations 1, 10, 12, and 13. Live specimens were photographed with 35 mm color slide film and electronic flash illumination in temporary aquaria or in trays. Specimens were relaxed in magnesium chloride solution judged isotonic with sea water by optical refractometer readings. Specimens were fixed in 10% formalin in sea water (4% formaldehyde solution) neutralized and buffered with 20 g/l hexamethylenetetramine and transferred to 70% ethanol on return to the National Museum of Natural History. Most of the material has been kept in alcohol for future dissection and histological analysis, but some specimens were dried for identification purposes. Photographs and voucher specimens have been deposited in the National Museum of Natural History, Smithsonian Institution, under the catalog numbers of the United States National Museum (USNM), uncataloged material designated CBC.

Station List

(Station numbers keyed to Figure 170)

Lagoon
1. Northwest side of cay, foot of pier; among discarded conch shells, 0.5 m.
2. Southwest end of cay; rubble area between sand and *Thalassia*, 0.5 m.

Back Reef
3. Main reef transect; patch-reef zone, 1 m.

Reef Flat
4. Northeast end of cay; *Penicillus* zone, 0.5 m.
5. Southeast end of cay; *Penicillus* zone, 0.5 m.
6. Coral-head/coral-pavement zone, 1 m.
7. Inner reef-crest zone, 0.5 m.

Reef Crest
8. Coral-rubble berm (storm ridge), intertidal to 0.5 m (Plate 5: *top left*).
9. Outer reef-crest zone, 0.5 m.

Inner Fore Reef
10. High-relief spur and groove zone, along the reef transect; bulk sample, 10–12 m.

Outer Fore Reef
11. Sand trough near transect; bottom of shoreward slope of outer ridge, 24 m.
12. Outer ridge near transect; bulk sample, 12 m.
13. Fore-reef slope near transect; bulk sample, 26 m; incidental 1973 samples, 15–28 m.

Species List

(* = new records for Belize)

Superfamily Ophiuroidea
  Family Gorgonocephalidae
    **Astrophyton muricatum* (Lamarck)
  Family Ophiomyxidae
    Ophiomyxa flaccida (Say)
  Family Ophiacanthidae
    **Ophiometrella glabra* (H. L. Clark)
  Family Hemieuryalidae
    **Sigsbeia murrhina* Lyman
  Family Amphiuridae
    **Amphiura fibulata* Koehler
    **A. stimpsonii* Lütken
    **Axiognathus squamatus* (Delle Chiaje)
    **Ophiostigma* sp.
  Family Ophiactidae
    **Ophiactis algicola* H. L. Clark
  Family Ophiotrichidae
    O. savignyi (Müller and Troschel)
    Ophiothrix (*Acanthophiothrix*) *suensoni* Lütken
    O. (*Ophiothrix*) *angulata* (Say)
    O. (*Ophiothrix*) *lineata* Lyman
    O. (*Ophiothrix*) *oerstedi* Lütken
  Family Ophionereidae
    Ophionereis reticulata (Say)
    **O. squamulosa* Koehler
  Family Ophiocomidae
    Ophiocoma echinata (Lamark)
    O. paucigranulata Devaney
    O. pumila Lütken
    O. wendti Müller and Troschel
    **Ophiocomella ophiactoides* (H. L. Clark)
    **Ophiopsila riisei* Lütken
  Family Ophiodermatidae
    **Ophioderma anitae*, new species
    O. appressum (Say)
    O. brevicaudum Lütken

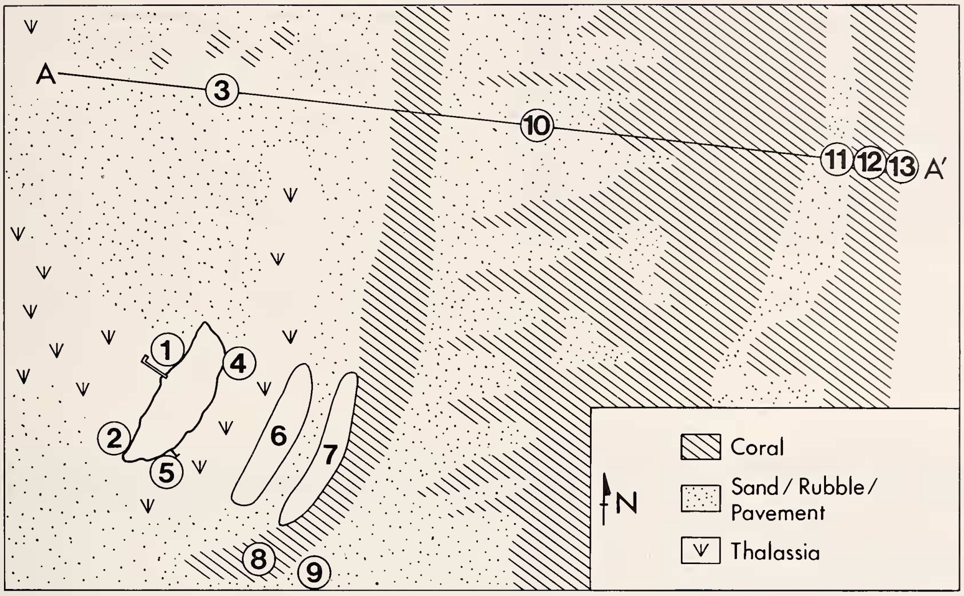

FIGURE 170.—Sketch map of collecting stations described in text (1, 2 = lagoon, 3 = back reef, 4–7 = reef flat, 8, 9 = reef crest; 10 = inner fore reef, 11–13 = outer fore reef; A–A′ = study transect).

**O. brevispinum* (Say)
O. cinereum Müller and Troschel
**O. guttatum* Lütken
O. phoenium H. L. Clark
O. rubicundum Lütken
**O. squamosissimum* Lütken
Ophioderma sp.
Ophioderma sp. juv.
Ophiurochaeta littoralis (Koehler)
Family OPHIURIDAE
Ophiolepis impressa Lütken
O. paucispina (Say)

Superfamily OPHIUROIDEA

Family GORGONOCEPHALIDAE

Astrophyton muricatum (Lamarck)

Euryale muricatum Lamarck, 1816:538.

Astrophyton muricatum.—Agassiz, 1835:172.—Müller and Troschel, 1842:122.—Lütken, 1859:258; 1869:68,106.—Lyman, 1865:192.—Ljungman, 1866:336.—Verrill, 1867: 341; 1899a:84; 1899b: 381.—Döderlein, 1911:7, 18, 53, 108, pl. 5: fig 1; 1927:24, 25.—H. L. Clark, 1915:188; 1919:56, 71; 1933:34, 42.—A. H. Clark, 1922:210.—Boone, 1933:103.—Engel, 1939:4.—Fontaine, 1953: 200.—John and Clark, 1954:140.—Cherbonnier, 1959: 261.—Fell, 1960:8.—Parslow and Clark, 1963:43.—Davis, 1966:435.—Roa, 1967:283.—Fricke, 1968:1.—Tommasi, 1970:11, pl. 2: fig. 3.—Godcharles and Jaap, 1973:56.—Zeiller, 1974:106 [color fig.].

Astrophyton costosum.—Lyman, 1865:192; 1882:256, 257, 266, 271, 290, 313, 326, pl. 35: figs. 17–25.—Nutting, 1895: 172.—Koehler, 1907:349.

Astrophytum muricatum.—A. H. Clark, 1921:52; 1954:376.

MATERIAL DEPOSITED.—USNM E17735 (1 spec.); USNM E19478 (1 spec.).

DISTRIBUTION.—One specimen was secured from a coral sample taken in 10–12 m in the spur and groove zone of the inner fore reef along the main study transect (station 10); the other specimen was collected by B. Spracklin on a lagoon patch reef, 1 km WSW of Carrie Bow Cay, 4 m (24 May 1975).

REMARKS.—The biology and living haits have been described by Davis (1966) and Fricke (1968).

Family OPHIOMYXIDAE

Ophiomyxa flaccida (Say)

Ophiura flaccida Say, 1825:151.

Ophiomyxa flaccida.—Lütken, 1859:79, 138.—Lyman, 1865:

178.—Ljungman, 1866:327.—Verrill, 1867:329; 1899a: 65; 1899b:366.—Rathbun, 1879:155.—Ives, 1889:178.—H. L. Clark, 1901:251; 1915:169; 1919:56, 71, pl. 1: figs. 1, 2; 1933:41.—Koehler, 1907:341; 1913:379; 1914:3, 132, 162.—A. H. Clark, 1921:51; 1922:210; 1939a:446; 1939b: 2: 1954:376.—Engel, 1939:4.—Fontaine, 1953:200.—Roa, 1967:282, fig. 10.—Tommasi, 1970:13, pl. 2: figs. 4, 5.—Devaney, 1974:129.—Zeiller, 1974:106 [color fig.].

MATERIAL DEPOSITED.—USNM E17759 (1 spec.); USNM E17779 (1 spec.); USNM E17780 (4 spec.); USNM E17782 (1 spec.); USNM E17857 (4 spec.).

DISTRIBUTION.—Found on the reef flat in the north *Penicillus* zone (station 4), in the coral-head/coral-pavement zone (station 6), just inside the reef crest (station 7), on the reef crest in the rubble of the coral berm (station 8), and just seaward in 0.5 m of water (station 9). Collected by bulk sample from the fore-reef slope (station 13).

REMARKS.—Taken by Devaney (1974:129) at Lighthouse Reef and Glover's Reef. As noted by H. L. Clark (1933), this species occurs along shore in very shallow water to depths below 183 m (100 fathoms).

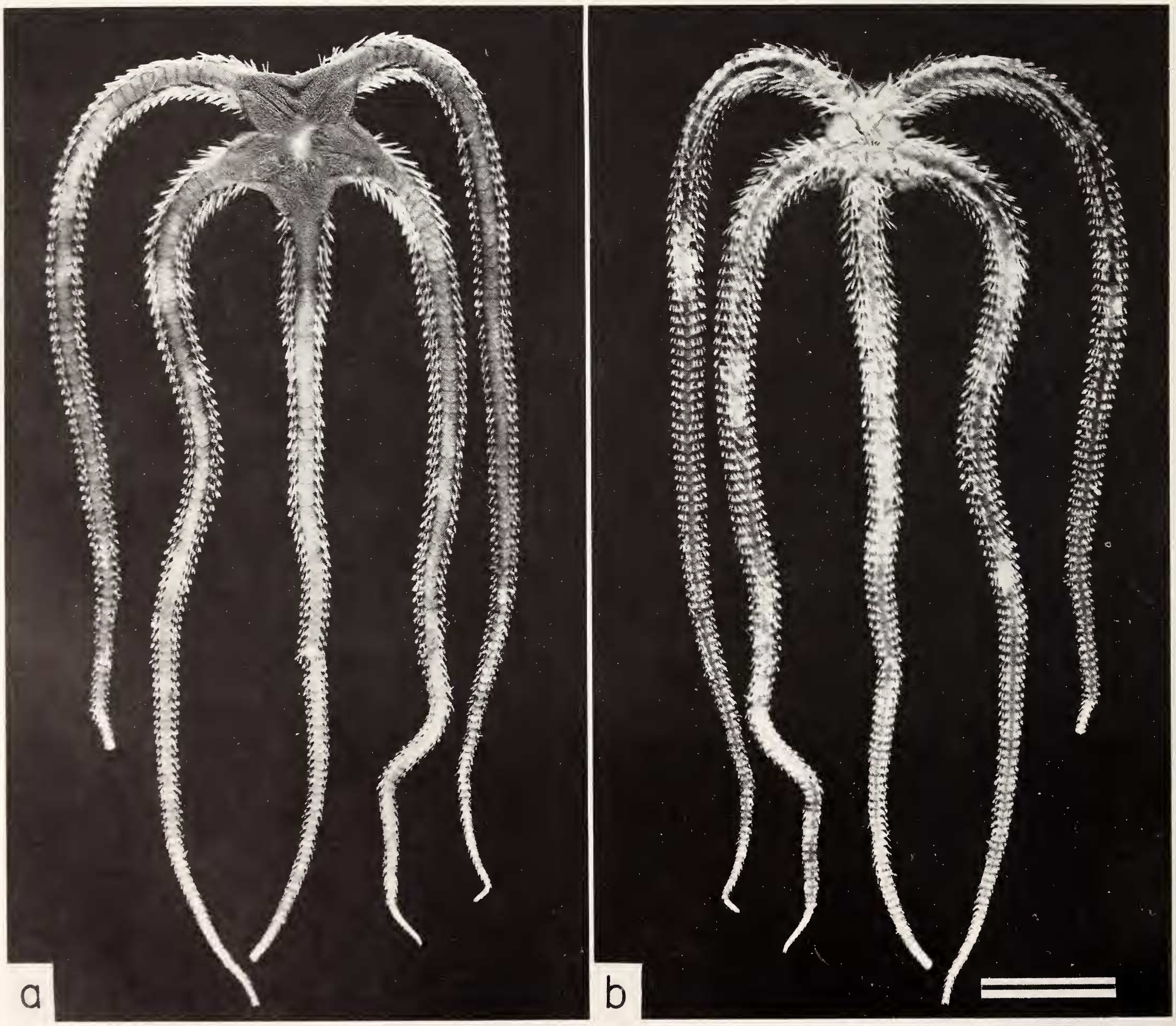

FIGURE 171.—*Ophiomitrella glabra*, USNM E17679, dry: *a*, aboral; *b*, oral. (Scale = 10 mm.)

Family OPHIACANTHIDAE

Ophiomitrella glabra (H. L. Clark)

FIGURE 171

Ophialcaea glabra H. L. Clark, 1901:249, pl. 15: figs. 1–4.
Ophiomitrella glabra.—H. L. Clark, 1915:210, 1919:56, 71; 1933:34, 43.—Parslow and Clark, 1963:26.

MATERIAL DEPOSITED.—USNM E17679 (1 spec.); USNM E17681 (1 spec.).

DISTRIBUTION.—One specimen was found on the reef crest in the rubble of the coral berm (station 8) by Kjell Sandved and one in a general sample taken from the fore-reef slope (station 13).

REMARKS.—New to Belize, the species was previously known only from the unique holotype found at Playa de Ponce, Puerto Rico.

Family HEMIEURYALIDAE

Sigsbeia murrhina Lyman

FIGURE 172

Sigsbeia murrhina Lyman, 1878:234, pl. 3: figs. 55, 58; 1882: 250, pl. 43: figs. 4–6; 1883:277; 1888:114, fig. 399.—Nutting, 1895:79.—Verrill, 1899a:72, pl. 2: figs. 1, 1a; 1899b:365, 381, pl. 42: fig. 7.—Koehler, 1914:133, 135, 163.—H. L. Clark, 1915:192; 1941:78.—A. H. Clark, 1921:52; 1954:376.

MATERIAL DEPOSITED.—UNSM E17682 (3 spec.).

DISTRIBUTION.—Six specimens were found in general samples from the fore-reef slope at depths from 16.0 to 27.5 m (station 13).

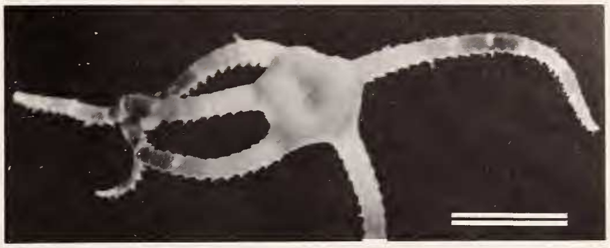

FIGURE 172.—*Sigsbeia murrhina*, USNM E17682, live. (Scale = 5 mm.)

DISTRIBUTION.—Three specimens were found among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1).

Family AMPHIURIDAE

Amphiura fibulata Koehler

Amphiura fibulata Koehler, 1913:359; 1914:2, 56, 64, 65, pl. 7: figs. 3–5.—H. L. Clark, 1915:234; 1933:35, 45.—A. H. Clark, 1954:377.—Thomas, 1962a:638, fig. 4.—Tommasi, 1965:3.
Amphiura (*Monamphiura*) *fibulata.*—Tommasi, 1970:45.

MATERIAL DEPOSITED.—USNM E17762 (1 spec.); USNM E17793 (1 spec.); USNM E17803 (1 spec.).

Amphiura stimpsonii Lütken

Amphiura stimpsonii Lütken, 1859:116.—Lyman, 1865:12; 1875:4, pl. 5: fig. 66; 1882:124–143; 1883:252.—Ljungman, 1866:320; 1871:631.—Rathbun, 1879:154.—Marktanner, 1887:299.—Verrill, 1899b:376.—H. L. Clark, 1901:247; 1915:232; 1919:56, 71; 1933:35, 45.—Koehler, 1914:2, 59, 64, pl. 7: figs. 1, 2.—A. H. Clark, 1922:210; 1954:377.—Mortensen, 1936:207.—Engel, 1939:4, 7.—Fontaine, 1953:200.—Thomas, 1962a:636, fig. 3.—Parslow and Clark, 1963:43.
Amphiura vivipara H. L. Clark, 1918:268, pl. 1: figs. 1, 2; 1919: 56, 71.
Monamphiura stimpsonii.—Fell, 1962:11.
Amphiura (*Monamphiura*) *stimpsonii.*—Tommasi, 1970:50, pl. 24: figs. 51–52.

MATERIAL DEPOSITED.—UNSM E17763 (2 spec.); USNM E17765 (1 spec.); USNM E17775 (1 spec.); USNM E17794 (4 spec.); USNM E17796 (1 spec.); USNM E17798 (1 spec.); USNM E17801 (1 spec.); USNM E17802 (1 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); and in a general sample from the fore-reef slope (station 13).

REMARKS.—H. L. Clark (1918:268) showed that this species is viviparous.

Axiognathus squamatus (Della Chiaje)

Ophiura elegans.—Leach, 1815:59
Asterias squamata Delle Chiaje, 1829:74.

Ophiocoma neglecta.—Forbes, 1841:30 [text-fig.].

Ophiolepsis squamata.—Müller and Troschel, 1842:92.

Amphiura squamata.—Lyman, 1865:122; 1882:125, 136, 291, 309, 310, 314, 321, 322, 324.—Koehler, 1907:305; 1913: 356.

Amphipholis elegans.—Ljungman, 1866:312.

Amphipholis squamata.—Ljungman, 1871:633.—Verrill, 1899b:312.—H. L. Clark, 1904:560, pl. 6: figs. 33, 34, pl. 7: figs. 43, 44; 1914:105, pl. 2: figs. 1–6; 1915:242. 1933: 36, 50.—Coe, 1912:81, pl. 17.—Koehler, 1914:2, 52, 66, 156.—A. H. Clark, 1922:210; 1954:377.—Bernasconi, 1926:146, pl. 3.—Engel, 1939:4, 8.—Fontaine, 1953: 201.—Thomas, 1962a:662, fig. 13.—Parslow and Clark, 1963:44.—Roa, 1967:286.

Amphiura tenera Rathbun, 1879:154.

Axiognathus squamatus.—Thomas, 1966:831.—Martin, 1968: 65.—Tommasi, 1970:37, pl. 16: fig. 36.—Boffi, 1972: 319.—Hendler, 1975:703.

MATERIAL DEPOSITED.—USNM E17764 (12 spec.); USNM E17792 (2 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1).

REMARKS.—The development of this viviparous species has been studied by numerous authors. H. L. Clark's (1933:50) statement that very young specimens may have six arms and show evidence of autotomy is probably based on Koehler's (1913:356) report of a six-armed specimen from Tortugas in which three arms are very short and in the process of regeneration; most likely either the specimen was misidentified or it regenerated a supernumerary arm following injury. Martin (1968) and Boffi (1972) have described aspects of the ecology of this species.

***Ophiostigma* sp.**

FIGURE 173

MATERIAL DEPOSITED.—USNM E17688 (1 spec.); USNM E17689 (1 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of water (station 10); and from the fore-reef slope in 26 m of water (station 13).

REMARKS.—All specimens have six rays and most show evidence of recent fissiparity. Although Koehler (1913) and H. L. Clark (1933; 1942) reported six-rayed fissiparous specimens of *Ophiostigma isacanthum*, the present material strongly suggests that the fissiparous six-rayed specimens are specifically distinct from the nonfissiparous five-rayed specimens of *O. isacanthum* and belong to an undescribed species. A. M. Clark (1967a) did not include *Ophiostigma* in her list of fissiparous ophiuroids, having previously suggested (in Parslow and Clark, 1963:37) that H. L. Clark's

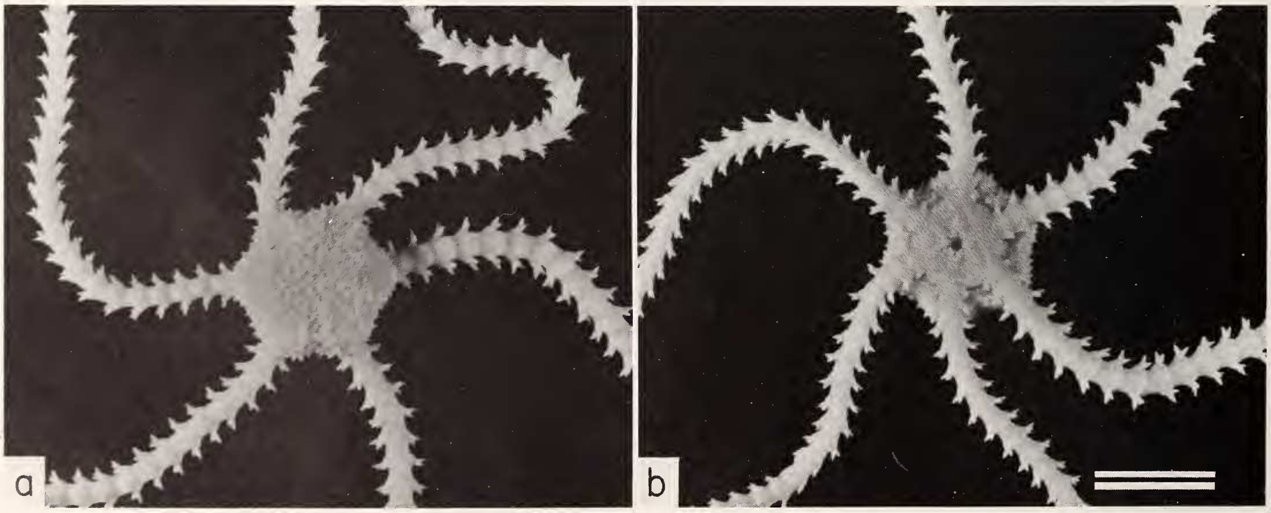

FIGURE 173.—*Ophiostigma* sp., USNM E17688, dry: *a*, aboral; *b*, oral. (Scale = 2 mm.)

(1942:377) Bermudan fissiparous specimen of *O. isacanthum* might instead be a specimen of *Ophiocomella ophiactoides*; that judgement now seems premature and calls for reexamination of the material. *Ophiostigma isacanthum* has most recently been described in detail by Thomas (1962a), but his material did not include six-rayed fissiparous specimens.

Family OPHIACTIDAE

Ophiactis algicola H. L. Clark

FIGURE 174

Ophiactis loricata.—H. L. Clark, 1901:246 [not Lyman, 1869:331].
Ophiactis plana.—H. L. Clark, 1915:264 Bermuda [not Lyman, 1869:330].
Ophiactis lymani.—H. L. Clark, 1918:303, pl. 4: figs. 5, 6; 1919:57, 72.—Tommasi, 1965:5, 6; 1970:22, pl. 7: fig. 14. [Not Ljungman, 1871:629].
Ophiactis algicola H. L. Clark, 1933:38, 56; 1942:377.

MATERIAL DEPOSITED.—USNM E17647 (1 spec.).

DISTRIBUTION.—One specimen collected from a general bulk sample from the fore-reef slope (station 13).

REMARKS.—The species is fissiparous (H. L. Clark, 1933; but not listed by A. M. Clark, 1967a) and this specimen has three old and three regenerating arms.

Ophiactis savignyi (Müller and Troschel)

Ophiolepis savignyi Müller and Troschel, 1842:95.
Ophiactis krebsii Lütken, 1856a:12.—Lyman, 1865:111.—Verrill, 1868:366; 1899b:376.—Ljungman, 1871:627.—Rathbun, 1879:153.—H. L. Clark, 1901:246.
Ophiactis virescens Lütken, 1856a:24.
Ophiolepis sexradia Grube, 1857:343.
Ophiactis reinhardtii Lütken, 1859:161, pl. 3: fig. 7a,b.
Ophiactis savignyi.—Ljungman, 1866:323.—Koehler, 1907:311; 1913:351; 1914:2, 41, 154.—H. L. Clark, 1914:96, pl. 1: figs. 1–19, pl. 3: figs. 12–14; 1915:265; 1918:305; 1919:57, 72; 1933:38, 59; 1942:377.—A. H. Clark, 1921:53; 1922:211; 1939a:447, 1939b:3; 1954:377.—Engel, 1939:4, 8.—Fontaine, 1953:201.—John and Clark, 1954:140.—Roa, 1967:288.—Tommasi, 1970:24, pl. 8: figs. 16, 17.—Boffi, 1972:319.—Devaney, 1974:129.—Pawson, 1978:11.
Ophiactis incisa von Martens, 1870:248.
Ophiactis brocki de Loriol, 1893:401.

MATERIAL DEPOSITED.—USNM E17732 (2 spec.); USNM E17797 (1 spec.); USNM E17804 (1 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); on the reef flat in the south *Penicillus* zone (station 5); in the coral-head/coral-pavement zone (station 6); in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of

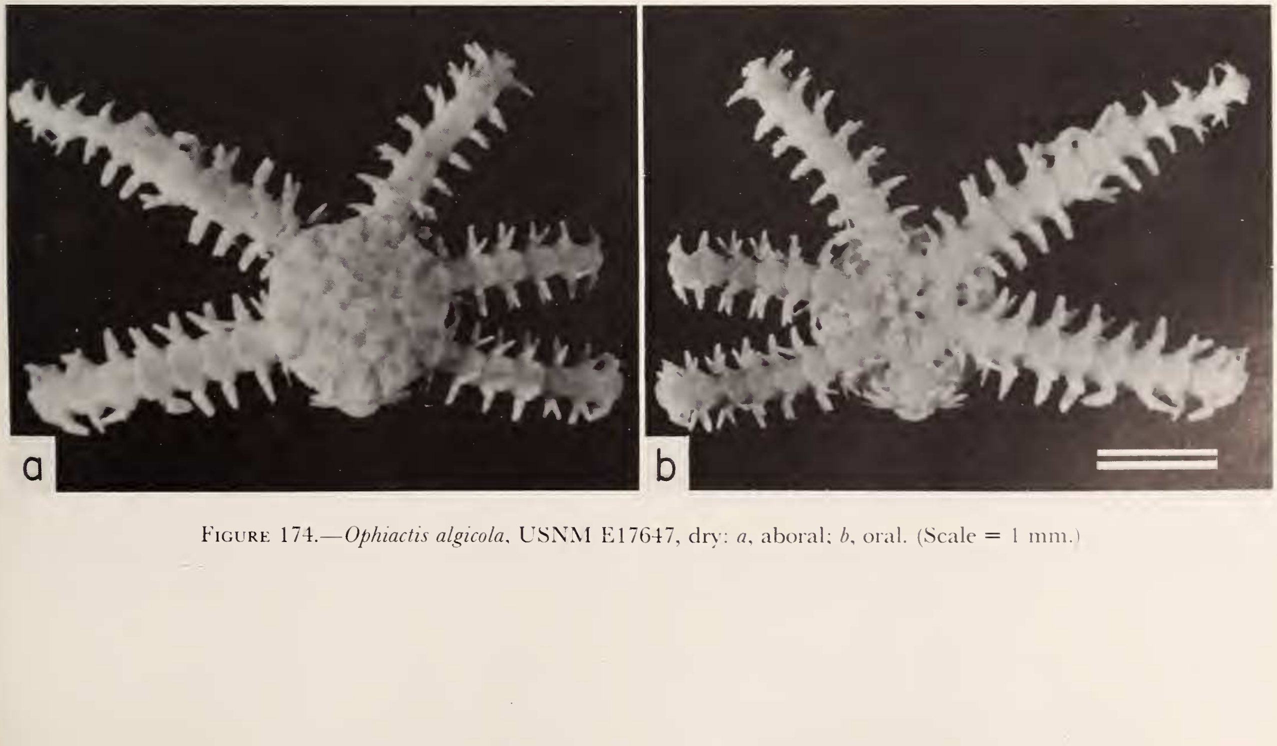

FIGURE 174.—*Ophiactis algicola*, USNM E17647, dry: *a*, aboral; *b*, oral. (Scale = 1 mm.)

water (station 10); from the sponge *Siphonodictyon coralliphagum* Rützler at 24 m in the sand trough of the outer fore reef (station 11), and from the fore-reef slope in 26 m of water (station 13).

REMARKS.—Two specimens from the fore-reef slope are five armed with the primary rosette perfectly intact, indicating that they never underwent autotomous fission. The relation of old to new arms in most specimens is 6 plus 0 or 3 plus 3, but one from the lagoon has the relation 2 plus 3. Previously reported from Glover's Reef (Devaney, 1974:129).

Family OPHIOTRICHIDAE

***Ophiothrix* (*Acanthophiothrix*) *suensoni* Lütken**

Ophiothrix suensonii Lütken, 1856a:16; 1859:250, pl. 4: fig. 2a–e.—Lyman, 1865:157; 1882:215, 218, 222, 223, 229, 312, 315, 326.—Rathbun, 1879:153.—Ives, 1889:178.—Verrill, 1899a:21; 1899b:375.—H. L. Clark, 1901:244; 1915:279; 1918:313; 1919:57, 72; 1933:38, 62.—Koehler, 1907:388; 1913:376; 1914:3, 121, 161.—A. H. Clark, 1921: 54; 1922:211; 1939a:447; 1954:377.—Boone, 1933:111, pl. 64.—Engel, 1939:4.

Ophiothrix suensoni.—Ljungman, 1866:331; 1871:627.—Parslow and Clark, 1963:45.—Roa, 1967:289.—Tommasi, 1971:7, figs. 21c, 22c, 23c.

Ophiothrix (*Acanthophiothrix*) *suensoni*.—A. M. Clark, 1967b: 638 643, 648, fig. 1j.—Tommasi, 1970:62.—Devaney, 1974:130.

MATERIAL DEPOSITED.—USNM E17734 (2 spec.); USNM E17787 (1 spec.); USNM E17808 (1 spec.); USNM E17850 (2 spec.).

DISTRIBUTION.—Collected in the spur and groove zone of the inner fore reef from a coral bulk sample in 10 to 12 m of water (station 10), and in 24 m in the outer fore reef near the bottom of a trough among, and in crevices of, coral clumps (station 11).

REMARKS.—Previously recorded from Belize (Koehler, 1914:122), Turneffe Islands, Lighthouse Reef, and Glover's Reef (Devaney, 1974: 130).

***Ophiothrix* (*Ophiothrix*) *angulata* (Say)**

Ophiura angulata Say, 1825:145.

Ophiothrix angulata.—Ayres, 1852:249.—Lütken, 1859:219.—Lyman, 1865:3, pl. 2: figs. 1–3; 1882:214, 216, 218, 219, 286, 287, 290, 312, 325.—Ljungman, 1866:331.—Ludwig, 1882:18.—Ives, 1889:178; 1890:332.—Verrill, 1899a:18; 1899b:375.—H. L. Clark, 1901:244; 1914:111, pl. 2: figs. 7–12, pl. 3: figs. 1–10, 15–19; 1915:269; 1918:312; 1919: 57, 72; 1933:38, 60; 1941:86.—Koehler, 1907:330; 1913: 375; 1914:3, 118, 160.—A. H. Clark, 1921:53; 1922:211; 1939a:447; 1954:377.—Boone, 1933:110.—Engel, 1939:4, 8.—Fontaine, 1953:202.—Tabb and Manning, 1961: 566.—Parslow and Clark, 1963:45.—Roa, 1967:289.—Tommasi, 1971:7, figs. 21b, 22b, 23b.—Boffi, 1972:319.—Godcharles and Jaap, 1973:57.

Ophiothrix violacea Müller and Troschel, 1842:115.—Lütken, 1859, pl. 4: fig. 1a–g.—Verrill, 1868:366.—Rathbun, 1879:152.—Koehler, 1907:339.

Ophiothrix (*Ophiothrix*) *angulata*.—A. M. Clark, 1967b:646.—Tommasi, 1970:54.—Devaney, 1974:130.

MATERIAL DEPOSITED.—USNM E17805 (3 spec.); USNM E17809 (1 spec.); USNM E17846 (5 spec.).

DISTRIBUTION.—Found among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); on the reef flat in the south *Penicillus* zone among crevices of rocks and shells (station 5); in the spur and groove zone of the inner fore reef from a coral bulk sample in 10 to 12 m of water (station 10); from the outer ridge of the outer fore reef (station 12); and from the fore-reef slope to approximately 28 m (station 13).

REMARKS.—Previously recorded from Belize (Koehler, 1914:122) and from the Turneffe Islands, Lighthouse Reef, and Glover's Reef (Devaney, 1974:130). Shades of green and brown in life have turned blue in many of the preserved specimens.

***Ophiothrix* (*Ophiothrix*) *lineata* Lyman**

Ophiothrix lineata Lyman, 1860:201.—Ives, 1889:178.—Verrill, 1899b:375.—Koehler, 1907:334, pl. 13: figs. 46, 47; 1913:376; 1914:3, 120, 161.—H. L. Clark, 1915:273; 1918: 315; 1919:57, 72; 1933:38, 62.—A. H. Clark, 1922:211; 1954:377.—Engel, 1939:4.—Tommasi, 1970:54.

Ophiothrix (*Ophiothrix*) *lineata*.—A. M. Clark, 1967b:647.—Devaney, 1974:131.

Not *Ophiothrix lineata*.—A. H. Clark, 1921:54, reidentified in A. H. Clark, 1939a:449, as *Ophiothrix platyactis* H. L. Clark, 1939.

MATERIAL DEPOSITED.—USNM E17761 (1 spec.).

REMARKS.—One specimen was found in the temporary aquaria on Carrie Bow Cay. Previously reported from Turneffe Islands (Devaney, 1974:131).

Ophiothrix (*Ophiothrix*) *oerstedi* Lütken

Ophiothrix orstedii Lütken, 1856a:15; 1859:149, pl. 4: fig. 3a–e.—Ljungman, 1866:331; 1871:626.—Ives, 1889:178; 1891:340.—Stearns, 1891:4.—Verrill, 1899a:20; 1899b:375.—H. L. Clark, 1901:244. 1915:276; 1918:313, 314; 1919:57, 72, pl. 2; 1933:38, 63.—Koehler, 1907:336; 1913:376; 1914:3, 121, 161.—A. H. Clark, 1921:54; 1922:211; 1939a:447; 1939b:3; 1954:377.—Engel, 1939:4, 8.—Roa, 1967:290.—Tommasi, 1970:53. [Includes the spellings *oerstedii*, *oerstedi*, and *orstedi*.]

Ophiothrix (*Ophiothrix*) *oerstedi*.—A. M. Clark, 1967b:647.—Devaney, 1974:131.

MATERIAL DEPOSITED.—USNM E17739 (1 spec.); USNM E17843 (1 spec.); UNSM E17844 (1 spec.); USNM E17849 (1 spec.).

DISTRIBUTION.—This species was widely taken. Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); under rocks in a rubble area between sand and *Thalassia* on the lagoon side of the south end of Carrie Bow Cay (station 2); on the reef flat in the coral-head/coral-pavement zone (station 6); just inside the reef crest (station 7); on the reef crest in the rubble of the coral berm (station 8); in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of water (station 10), and in 15 to 28 m on the fore-reef slope (station 13).

REMARKS.—Previously reported from Lighthouse Reef and Glover's Reef (Devaney, 1974:131). Shades of brown in life have turned blue in the preserved specimens.

Family OPHIONEREIDAE

Ophionereis reticulata (Say)

Ophiura reticulata Say, 1825:148.

Ophiolepis nereis Lütken, 1856a:11; 1856b:24.

Ophionereis reticulata.—Lütken, 1859:212, pl. 3: fig. 6a–c.—Lyman, 1865:141; 1875:4; 1878:224; 1882:162, pl. 40: figs. 13–15; 1883:253.—Ljungman, 1866:310; 1871:620.—Verrill, 1867:342; 1868:366; 1899a:30; 1899b:377.—Rathbun, 1879:152.—Ives, 1889:177.—Lütken and Mortensen, 1899:162, pl. 13: fig. 10.—H. L. Clark, 1901:249; 1915:289; 1919:57, 58, 72; 1933:39, 64; 1942:378.—Koehler, 1907:315; 1913:360; 1914:2, 44, 59, 155.—A. H. Clark, 1921:42, 55; 1922:211; 1939a:450; 1954:377.—Engel, 1939:5, 8.—Fontaine, 1953:202.—A. M. Clark, 1953:67, 68, 73, fig. 3a, pl. 1: figs. 1, 2.—Millott, 1953:96–99.—Brito, 1960:2, fig. 2.—Tabb and Manning, 1961:566.—Parslow and Clark, 1963:27, 47.—Tommasi, 1970:86, 88, pl. 40: figs. 92, 93.—Boffi, 1972:319.—Godcharles and Japp, 1973:57.—Thomas, 1973:586, figs. 1, 5A.—Devaney, 1974:132.

Amphiura stearnsi Ives, 1891:339, 340, pl. 16: figs. 1–3.

Ophionereis olivacea.—Roa, 1967:284, fig. 12 [not *O. olivacea* H. L. Clark, 1901].

MATERIAL DEPOSITED.—USNM E17738 (1 spec.); USNM E17851 (2 spec.).

DISTRIBUTION.—Collected in the lagoon at the south end of South Water Cay and from the pile of discarded conch shells at the foot of the pier of Carrie Bow Cay (station 1); on the reef flat in both the north and south *Penicillus* zone (stations 4 and 5); and from just inside the reef crest (station 7). Two juvenile specimens were collected by bulk sample from the fore-reef slope (station 13).

REMARKS.—Previously reported from Lighthouse Reef (Devaney, 1974:132).

Ophionereis squamulosa Koehler

FIGURE 175

Ophionereis dubia.—H. L. Clark, 1901:248 [not *O. dubia* Müller and Troschel, 1842].

Ophionereis squamata.—Koehler, 1913:360, pl. 21: figs. 4–6 [not *O. squamata* Ljungman, 1866:310].

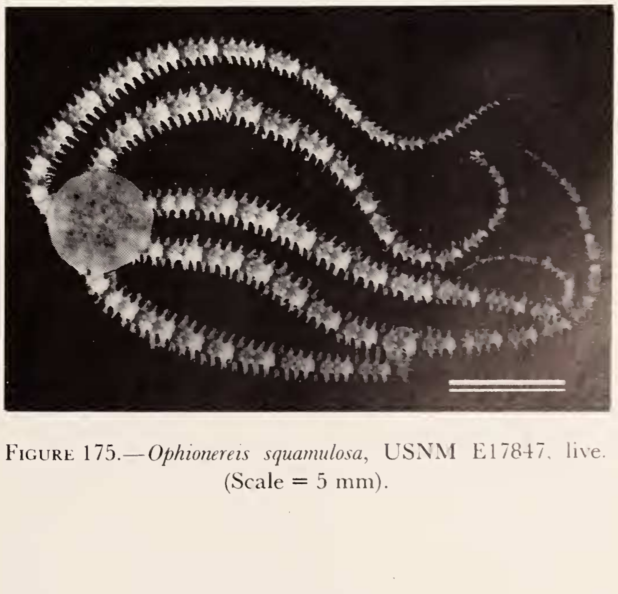

FIGURE 175.—*Ophionereis squamulosa*, USNM E17847, live. (Scale = 5 mm).

Ophionereis squamulosa Koehler, 1914:2, 44.—H. L. Clark, 1915:290; 1918:326; 1919:57, 58, 59, 72; 1933:39, 65.—Mortensen, 1921:171–177, pl. 31: figs. 1–6.—Pearson, 1936:70–72 [possibly *O. reticulata*].—A. H. Clark, 1939a: 450.—A. M. Clark, 1953:67, 71, fig. 2, pl. 3: figs. 3, 4.—Parslow and Clark, 1963:27, 47.—Tommasi, 1970:87, 88, pl. 41: fig. 94.—Thomas, 1973:588, figs. 2, 5b.

Ophionereis reticulata.—Roa, 1967:284 [probably *O. squamulosa*].

MATERIAL DEPOSITED.—USNM E17847 (1 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); on the reef flat in the coral head/coral pavement zone (station 6); and from the spur and groove zone of the inner fore reef in 10 to 12 m of water (station 10).

Family OPHIOCOMIDAE

Ophiocoma echinata (Lamarck)

Ophiura echinata Lamarck, 1816:543.

Ophiocoma echinata.—Agassiz, 1835:192.—Lütken, 1859:244, pl. 4: fig. 7a–d.—Lyman, 1865:81.—Ljungman, 1871: 621.—Rathbun, 1879:152.—Ives, 1889:177.—Grave, 1898:6, figs. 1–6.—Verrill, 1899a:22; 1899b:375.—H. L. Clark, 1901:245; 1915:291; 1919:57, 72; 1921:125; 1933: 39, 65; 1941:89.—Koehler, 1907:325; 1913:374; 1914:3, 117, 159.—A. H. Clark, 1921:55; 1922:212; 1939a:450, pl. 54: fig. 4; 1954:377.—Engel, 1939:5, 8.—Fontaine, 1953: 199, 203.—John and Clark, 1954:140.—Parslow and Clark, 1963:46.—Roa, 1967:292.—Tommasi, 1970:81.—Devaney, 1974:132.—Zeiller, 1974:107 [color fig.].

Ophiocoma crassispina Say, 1825:147.—Ljungman, 1866: 329.—Ives, 1889:177.

MATERIAL DEPOSITED.—USNM E17845 (1 spec.); USNM E17854 (3 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); under rocks in a rubble area between sand and *Thalassia* on the lagoon side of the south end of Carrie Bow Cay (station 2); in the patch reef zone of the back reef along the transect (station 3); on the reef flat in both the north and south *Penicillus* zone (stations 4 and 5); among coral rubble in the coral-head/coral-pavement zone (station 6); just inside the reef crest (station 7); on the reef crest in the rubble of the coral berm (station 8); and in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of water (station 10).

REMARKS.—Very common. Previously reported from Lighthouse Reef and Glover's Reef (Devaney, 1974:132).

Ophiocoma paucigranulata Devaney

Ophiocoma paucigranulata Devaney, 1974:132, figs. 5–8.

MATERIAL DEPOSITED.—USNM E17783 (19 spec.); USNM E17784 (1 spec.); USNM E17785 (1 spec.); USNM E17786 (3 spec).

DISTRIBUTION.—Twenty-five specimens collected on the reef crest in the rubble of the coral berm (station 8), and one specimen taken by bulk sample from the outer ridge of the outer fore reef (station 12).

REMARKS.—Devaney (1974:132) described this species on the basis of two specimens from Long Cay, Lighthouse Reef. Our specimens have the disc thoroughly covered with granules but otherwise they agree with Devaney's description.

Ophiocoma pumila Lütken

Ophiocoma pumila Lütken, 1859:141, 146, pl. 4: fig. 5a–c [not 1859:248, pl 4: fig. 5d, = *Ophiocomella ophiactoides* (H. L. Clark)].—Lyman, 1865:71.—Ljungman, 1866:328; 1871: 621.—Ives, 1889:177.—Verrill, 1899a:23; 1899b:375.—H. L. Clark, 1901:245; 1915:293; 1919:57, 72; 1921:131; 1933:39, 67.—Koehler, 1907:326; 1913:375; 1914:3, 117, 160.—A. H. Clark, 1921:55; 1922:212; 1939a:451 [not pl. 54: fig. 3 = *Ophiocomella ophiactoides*]; 1954:377.—Engel, 1939:5, 9.—Fontaine, 1953:199, 203.—Roa, 1967:292, fig. 22.—Tommasi, 1970:82.—Devaney, 1970:10, 28, 29, 30–32, fig. 16; 1974:139.

MATERIAL DEPOSITED.—USNM E17799 (2 spec.); USNM E17807 (3 spec.); USNM E17853 (1 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); on the reef flat under coral rubble in the coral-head/coral-pavement zone (station 6); just inside the reef crest (station 7); on the reef crest in the rubble of the coral berm (station 8); in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of water (station 10), and in about 26 m of water on the fore-reef slope (station 13).

REMARKS.—Common. One specimen from station 1 has six arms and shows no evidence of fissiparity; it is not *Ophiocomella ophiactoides.* Previously reported from Belize (Koehler, 1914:160) and from Turneffe Islands, Lighthouse Reef, and Glover's Reef (Devaney, 1974:139).

Ophiocoma wendti Müller and Troschel

Ophiocoma wendti Müller and Troschel, 1842:99.—Ljungman, 1871:621.—Devaney, 1970:34, 35, 37; 1974:140.

Ophiocoma riisei Lütken, 1859:243, 245, pl. 4; fig. 6a–d.—Lyman, 1865:76.—Ljungman, 1866:328.—Rathbun, 1879:152.—Ives, 1889:177.—Stearns, 1891:4.—Verrill, 1899a:22; 1899b:375.—H. L. Clark, 1901:245; 1915:293; 1919:57, 72; 1921:128; 1933:39, 66.—Koehler, 1907:326; 1913:375; 1914:3, 118, 159.—A. H. Clark, 1921:56; 1922: 212; 1939a:450, pl. 54: fig. 5; 1954:377.—Engel, 1939:5.—Fontaine, 1953:199, 203.—Parslow and Clark, 1963:47.—Roa, 1967:292.—Tommasi, 1970:82.

Not *Ophiocoma wendti.*—Koehler, 1907:327, pl. 13: fig. 38.—H. L. Clark, 1921:129.

MATERIAL DEPOSITED.—USNM E17733 (1 spec.); USNM E17737 (1 spec.); USNM E17855 (2 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); on the reef flat in the north and south *Penicillus* zones (stations 4 and 5); under coral rubble in the coral-head/coral-pavement zone (station 6); on the reef crest in the rubble of the coral berm (station 8); in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of water (station 10); and by bulk sample from the outer ridge of the outer fore reef (station 12).

REMARKS.—Common. Previously reported from Belize (Koehler, 1914:159, as *O. riisei* Lütken) and from Lighthouse Reef and Glover's Reef (Devaney, 1974:140).

Ophiocomella ophiactoides (H. L. Clark)

Ophiocoma pumila [part] Lütken, 1859:248, pl. 4: fig. 5d [not 1859:141, 146, pl. 4: fig. 5a–c].—A. H. Clark, 1922:212; 1939a:451, pl. 54: fig. 3.—H. L. Clark, 1942:378 [questionable].

Ophiacantha ophiactoides H. L. Clark, 1901:249, pl. 15: figs. 5–8; 1915:207; 1933:34, 43.

Ophiacantha oligacantha H. L. Clark, 1918:265–267, pl. 7: fig 5; 1919:56, 71.

Ophiocomella caribbaea A. H. Clark, 1939b:7–8.

Ophiocomella ophiactoides.—A. M. Clark in Parslow and Clark, 1963:37, fig. 11; 1967:151.—Roa, 1967:291, fig. 21.

MATERIAL DEPOSITED.—USNM E17736 (1 spec.).

DISTRIBUTION.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1); on the reef flat in the south *Penicillus* zone (station 5); and in the coral-head/coral-pavement zone (station 6).

REMARKS.—Five specimens have recently autotomized and have three arms and a broken disc. Of these, one is 2+1+0 and one is 1+2+0 (old to regenerating to new arms). Of the other specimens, one has five arms and shows no evidence of fissiparity; fourteen have six arms, showing three old and three regenerating arms when the distinction can be made, and two of these can be further categorized as 2+1+3; one has six arms with two old and four regenerating arms; and one has seven arms with four old and three regenerating arms.

Ophiopsila riisei Lütken

FIGURE 176

Ophiopsila riisei Lütken 1859:136, pl. 5: fig. 2a–c.—Lyman, 1865:150, figs. 16–17.—Ljungman, 1866:330; 1871:621.—Rathbun, 1879:152.—Verrill, 1899a:23.—H. L. Clark, 1901:245; 1915:299; 1918:330; 1919:57, 72; 1933:39, 67.—Koehler, 1907:315; 1914:2, 45, 155.—A. H. Clark, 1939a: 452; 1954:377.—Roa, 1967:293.—Tommasi, 1970:85.

MATERIAL DEPOSITED.—USNM E17648 (2 spec.); USNM E17758 (7 spec.); USNM E17790 (1 spec.).

DISTRIBUTION.—Twelve specimens from coral substrate from the fore-reef slope (station 13).

REMARKS.—One specimen has an amphiurid clinging mouth to mouth. Three arms of the amphiurid are extended in the gutter formed by the lowermost *Ophiopsila* arm spines (Figure 176). Without separating the organisms, identification of the amphiurid as cf. *Amphiura stimpsoni* is only tentative.

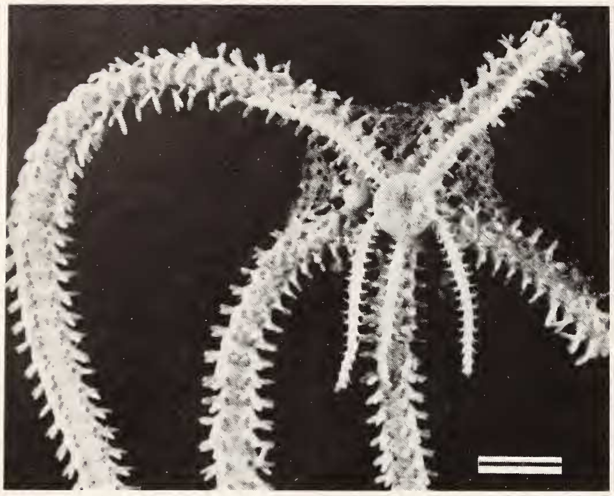

FIGURE 176.—*Ophiopsila riisei*, with small amphurid cf. *Amphiura stimpsonii* clinging mouth to mouth; USNM E17648, dry. (Scale = 2 mm.)

Family OPHIODERMATIDAE

Ophioderma anitae new species

FIGURES 177, 178*a*; PLATE 5: *top right*

MATERIAL DEPOSITED.—Nine specimens collected on the reef crest in the rubble of the coral berm (station 8) on 3, 5, and 7 May 1974.

Holotype: USNM E17641, 5 May 1974 (photographed).

Paratypes: USNM E17642 (1 spec., photographed), USNM E17643 (1 spec.); USNM E17644 (2 spec.), USNM E17645 (3 spec.), all 3 May 1974; USNM E17646 (1 spec.), 7 May 1974.

DIAGNOSIS.—Upper arm plates composed of a single piece, not fragmented; proximal upper arm plates nearly twice as broad as long, broadly in contact, with slight concave arc to distal edge. Disc granules fine, closely spaced, not squamose. Oral and adoral shields and small radial shields not covered by granules. Arms long, up to five and two-thirds times disc diameter, uniformly tapering, circular in section proximally, flat in section near the tip, exceedingly smooth where arm spines are pressed in. Arm spines 7 to 9, rarely 10. Disc grayish brown with yellow splotches, white underside; arms brown above, buff below, yellow-brown arm spines.

DESCRIPTION.—*Holotype:* Disc diameter 18.4 mm. Arm length from edge of disk 104.6 mm.

The disc is about circular with slight interradial swellings. It is covered on both surfaces with very fine granules that are closely spaced but not touching, and that on the upper surface leave only the radial shields exposed. The radial shields are very small and only measure about 1.2 mm in length; they are irregularly oval, about two-thirds as broad as long. The two shields of each pair are separated by a space about as wide as the width of the arm base. The granules of the upper surface of the disc do not pass out onto the upper surface of the arms or onto the few disc scales that form short radial notches, which encompass two minute upper arm plates, a half-exposed upper arm plate and an almost fully exposed upper arm plate.

The under surface of the disc is covered with granules identical with those of the upper surface, but the oral and adoral shields and the scales between he outer genital slits and the arm bases are free of granules. The inner genital slits extend from near the distal edge of the first side arm plate to one or less granules short of the oral shields. The outer genital slits are located approximately at the level of the fifth side arm plate and are bordered on their interradial edge by 14 to 16 granules.

The oral shields are large, almost five-sided, not quite twice as wide as high; the distal border is almost straight or slightly concave except in the madreporic interradius where it is slightly convex; the proximal corner is broadly rounded and confluent with the adjoining sides, and at its tips there is a small to minute supplementary plate without granules. The adoral shields form broad lobes at the radial corners of the oral shields and adjoin the outermost oral papillae, the lower edge of the buccal tentacle scale and the lateral corners of the first (zeroeth in terms of visible arm segments) ventral arm plate; they are separated by granules from the first side arm plates. The oral plates are concealed by granules. Not counting the buccal tentacle, there are nine oral papillae on the side of most jaw angles, but sometimes eight or 10. The outermost are broadest, about as

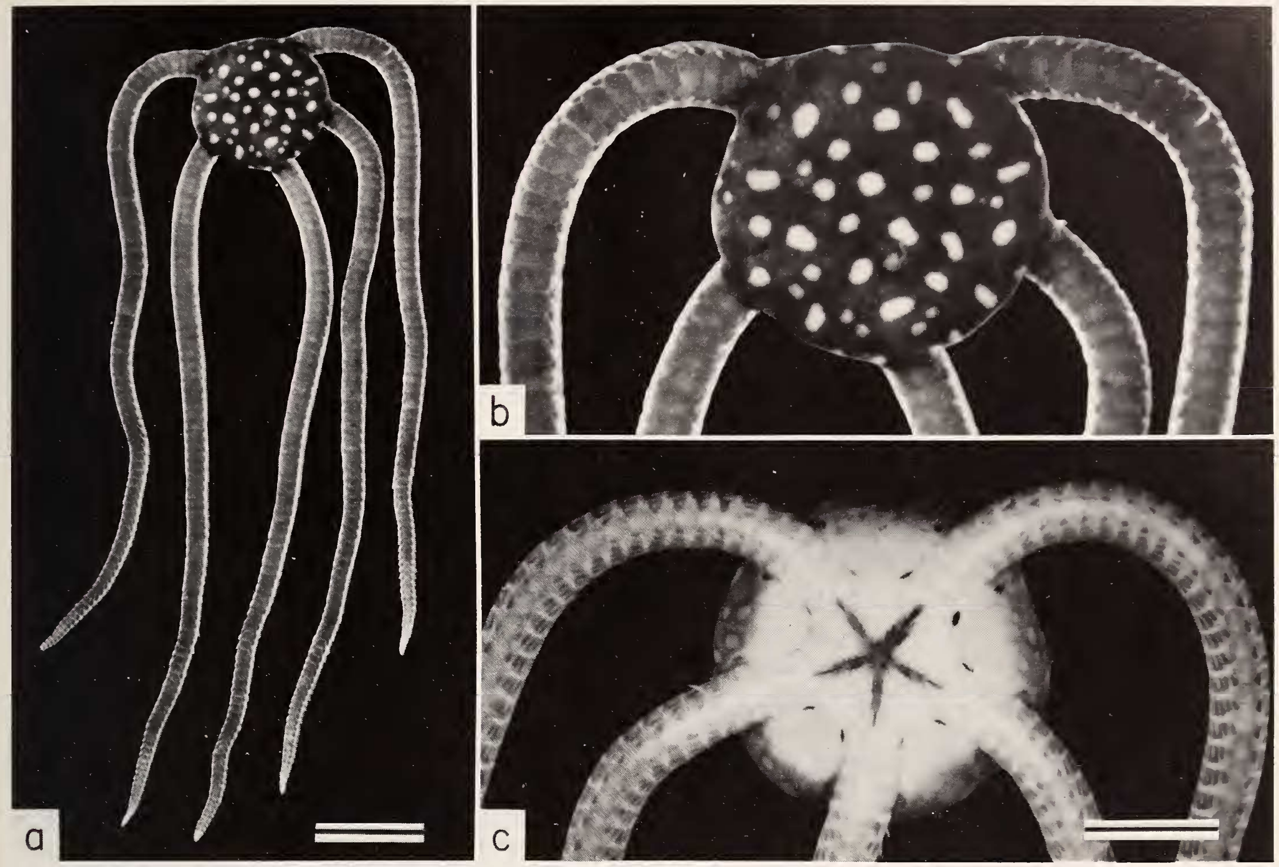

FIGURE 177.—*Ophioderma anitae*, USNM E17641, holotype, live: *a*, *b*, aboral; *c*, oral. (Scale = 10 mm for *a*; 5 mm for *b*, *c*.)

broad as long; the others are somewhat prism shaped, about twice as long as broad, becoming more pointed toward the apex of the jaw, overlapping in the direction of the jaw apex; the two at the apex of the jaw are again quite large and overlie the vertical row of teeth.

The arms are circular in section proximally, long, and very slightly and uniformly tapering in both width and thickness, gradually becoming very flat in section near the arm tip; exceedingly smooth where arm spines are pressed against the side of the arms.

Upper arm plates composed of a single piece, not fragmented. The upper arm plates beyond the radial notch are very wide, nearly rectangular but having a subtle yet distinct concave arc to the distal edge, changing to a similarly subtle convex arc which strengthens near the uppermost arm spine. Viewed from above, the proximal upper arm plates are slightly more than twice as wide as long. Near the arm tips the plates become trapezoidal, about as wide as long, as the side arm plates encroach on the upper surface of the arm. The upper arm plates are broadly in contact except for the last 10 or so segments at the arm tip.

The first lower arm plate, not associated with a visible arm segment, is about twice as broad as long; the distal edge is shallowly rounded or very slightly angular. Between this and the lower arm plate of the first arm segment there is a pair of narrow slit-like, almost concealed, pores. There are no such pores between succeeding lower arm plates. The succeeding lower arm plates overlap slightly and appear nearly circular proximally, rounded-octagonal more distally, owing in part to strong overlap by the inner tentacle scales; close to the tip of the arm they ultimately become fan shaped as the side arm plates encroach further onto the under surface of the arm.

The side arm plates abut in smooth contour the upper and lower arm plates, giving the arm its very smooth nearly circular section. The arm spines also match this contour when pressed against the side of the arm. The arm spines are therefore flat; they gradually increase in length from uppermost to lowermost, and taper to a blunt tip. Length of uppermost arm spines about half an arm segment long, overlapping and often extending beyond the rounded lower edge of the upper arm plate. Lowermost arm spines slightly overlap succeeding tentacle scales, with greater overlap on the first seven arm segments. The number of arm spines by segment are given in Table 28.

Two tentacle scales are present except at the very tip of the arm where only one is seen. Outer tentacle scale substantially wider than inner, squarish, resembling a ninety degree quadrant of a circle, and overlapping the articular base of the lowermost arm spine. Inner tentacle scale approximately oval, about two and one-half to three times as long as broad, about half an arm segment long, and about one-half to one-third again as long as the outer tentacle scale. The distance between the inner edges of the inner tentacle scales of two sides of an arm is about one and one-half to one and two-thirds the length of one inner tentacle scale (Figure 178*a*).

Coloration, grayish brown with yellow splotches, is shown in Plate 5 (*top right*). In alcohol yellow areas have turned white, and the brown has dulled on drying. The yellow splotches vary from nearly circular to oval and are somewhat smaller than the radial shields. Radial shields are the same brown as the ground color of the disc; however, the disc scales beneath the brown granules are only tinged with brown in the preserved specimen. Side arm plates are brown, under surface of disc white, under arm plates buff, and arm spines yellow-brown. There are no banding patterns on the arms.

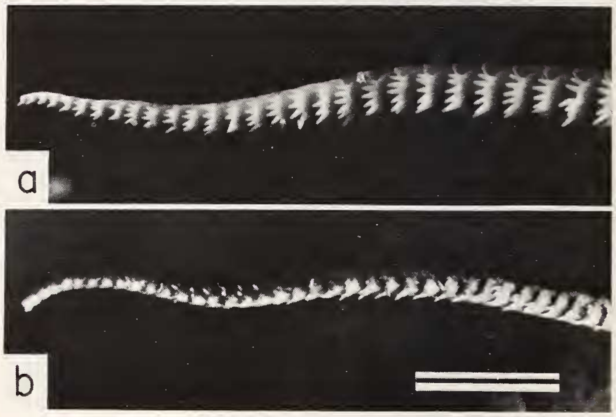

FIGURE 178.—Comparison of arm tips in two species of *Ophioderma*: *a*, *O. anitae*, USNM E17645, dry; *b*. *O. rubicundum*, USNM E17683, dry. (Scale = 5 mm.)

TABLE 28.—Number of arm spines by segments in specimens of *Ophioderma anitae*, new species

Specimen	*Segment number*																									*Disc diameter (mm)*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
HOLOTYPE																										
USNM E17461	3	4	5	6	7	7	9	9	9	9	10	9	8	9	9	9	9	9	9	9	9	8	9	9	8	18.5
PARATYPES																										
USNM E17646	3	3	5	6	7	7	8	9	9	9	9	9	9	8	9	9	8	8	8	8	7	8	8	8	8	17.3
USNM E17644	2	3	4	5	6	7	8	8	8	8	8	8	8	8	8	8	8	7	8	7	7	7	7	7	7	17.0
USNM E17645	2	3	4	5	6	6	7	9	9	9	9	9	9	8	9	9	10	9	9	9	8	8	8	9	8	16.3
USNM E17645	3	3	4	5	6	7	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	9	8	9	14.0
USNM E17645	3	4	5	6	7	8	9	8	9	9	9	8	9	8	8	8	8	8	8	8	8	8	8	8	8	13.7
USNM E17643	2	4	4	5	6	7	8	7	7	8	7	9	8	8	8	8	8	9	8	8	8	8	8	8	8	13.5
USNM E17644	3	3	5	5	6	7	8	8	8	8	8	7	8	8	8	8	8	8	8	8	8	7	7	7	7	12.0
USNM E17642	2	4	4	5	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	7	7	11.3

Paratypes: Disc diameters range from 11.3 to 17.3 mm. In the smaller specimens the arms are disproportionately shorter, the outer genital slit is beside the fourth side arm plate, there can be only seven or eight oral papillae, the yellow markings are more commonly larger than the radial shields, often there is no evidence of a supplementary plate at the proximal corner of the oral shield, and the oral shields are more nearly as wide as high.

COMPARISON WITH OTHER SPECIES.—*Ophioderma anitae* keys to the *O. cinereum*, *O. phoenium*, and *O. rubicundum* couplets of H. L. Clark's (1933) key, and to the *O. pallidum* (Verrill)-*O. phoenium* couplet in Ziesenhenne's (1955) key. *Ophioderma cinereum* is distinguished from the present species by its subdivided upper arm plates; *O. phoenium* is recognized by adoral shields covered with granules; *O. rubicundum* is closest but is entirely different in color and details of morphology. In a specimen of *O. rubicundum* from the same habitat (USNM E17683) with disc diameter 14.8 mm the length of the first 15 segments from the mouth frame is 14.5 mm, whereas in a specimen of *O. anitae* (USNM E17645) with disc diameter 14.0 mm the length of the first 15 segments from the mouth frame is 15.3 mm (Figure 178). Further, the arm tips of *O. rubicundum* are more slender and not as flattened as in *O. anitae* (Figure 178).

ETYMOLOGY.—Named for Anita Pruzan.

Ophioderma appressum (Say)

PLATE 5: *top right*

Ophiura appressa Say, 1825:151.—Lyman, 1865:34.—Rathbun, 1879:151.—Ives 1889:175.—Verrill, 1899a:6.—H. L. Clark, 1901:242.—A. H. Clark, 1939b:10.

Ophioderma virescens Lütken, 1859:86, pl. 1: fig. 4a–d.

Ophioderma appressum.—Ljungman, 1866:304; 1871:615.—Lyman, 1882:9.—Koehler, 1913:353.—H. L. Clark, 1915: 300; 1919:57, 72; 1933:40, 68; 1942:379.—A. H. Clark, 1922:213; 1939a:452; 1954:377.—Boone, 1933:113, pls. 66, 75b, 76b.—Engel, 1939:5, 9.—Caso, 1951:219, 222, 243, 249, 254, figs. 15–18; 1953:222.—Ziesenhenne, 1955: 188, 200.—Costa and Costa, 1962:3.—Parslow and Clark, 1963:47.—Roa, 1967:294.—Boffi, 1972:319.—Devaney, 1974:141, fig. 9.—Zeiller, 1974:107 [color fig.].

Ophioderma appressa.—Koehler, 1907:281; 1914:1, 3, 147.—A. H. Clark, 1921:56: 1939b:10.—Caso, 1961:176–178, figs. 74, 75.—Tommasi, 1970:65.

MATERIAL DEPOSITED.—USNM E17676 (3 spec.); USNM E17678 (2 spec.); USNM E17680 (2 spec.).

DISTRIBUTION.—Two specimens collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1). Very common on the reef flat where it was collected in the north and south *Penicillus* zones (stations 4 and 5), and in the coral-head/coral-pavement zone (station 6). Collected just inside the reef crest (station 7) and on the reef crest in the rubble of the coral berm (station 8).

REMARKS.—Previously reported from Lighthouse Reef and Glover's Reef (Devaney, 1974: 141).

Ophioderma brevicaudum Lütken

Ophioderma brevicaudum Lütken, 1856a:8; 1859:94, pls. 1, 2: fig. 3a–c.—H. L. Clark, 1915:300; 1919:57, 72; 1933:40, 69.—A. H. Clark, 1922:213; 1939a:452, pl. 54: figs. 1, 2; 1954:377.—Engel, 1939:5, 9.—John and Clark, 1954: 140.—Ziesenhenne, 1955:188, 199.—Roa, 1967:294.—Devaney, 1974:141.

Ophiura brevicauda.—Verrill, 1899a:5.—H. L. Clark, 1901: 242.

Ophioderma brevicauda.—Ljungman, 1866:303; 1871:615.—Koehler, 1907:281; 1914:1, 4, 147.—A. H. Clark, 1921:56.

MATERIAL DEPOSITED.—USNM E17677 (2 spec.).

DISTRIBUTION.—Ten specimens collected on the reef flat in the south *Penicillus* zone (station 5), in the coral rubble of the coral-head/coral-pavement zone (station 6), and from just inside the reef crest (station 7). One specimen also collected on the reef crest in the rubble of the coral berm (station 8).

REMARKS.—Previously reported from Lighthouse Reef and Glover's Reef (Devaney, 1974: 141).

Ophioderma brevispinum (Say)

Ophiura brevispina Say, 1825:149.—Lyman, 1865:18.—Rathbun, 1879:151.—Ives, 1889:175.—Verrill, 1899a:4.—Brooks and Grave, 1899:83, pls. 1, 2: figs. 1–5.—H. L. Clark, 1901:242.

Ophiura olivaceum Ayres, 1852:134.

Ophioderma serpens Lütken, 1859:86, pls. 1, 2: fig. 6a–c.

Ophiura olivacea.—Lütken, 1859:96.—Grave, 1899:92, figs. 1–5.

Ophioderma olivaceum.—Ljungman, 1866:304.

Ophioderma brevispina.—Ljungman, 1866:303; 1871:615.—Lyman, 1882:9.—Koehler, 1907:281; 1913:354; 1914:1, 4, 147.—Fontaine, 1953:204.—Cherbonnier, 1959:261–262, figs. 5a,b, 6a,b.—Tabb and Manning, 1961:566.—Parslow and Clark, 1963:48.—Tommasi, 1970:66.

Ophioderma brevispinum.—H. L. Clark, 1915:300; 1919:57, 72; 1933:40, 70; 1941:89.—Engle, 1939:5, 9.—A. H. Clark, 1954:377.—Ziesenhenne, 1955:188, 198.—Roa, 1967:294, fig. 24.—Godcharles, 1971:28, 33.—Godcharles and Jaap, 1973:57.—Stancyk, 1973:10.

Material Deposited.—USNM E17649 (1 spec.).

Distribution.—One specimen was collected in the north *Penicillus* zone under rubble (station 4).

Remarks.—The specimen was orange in life but has lost all color in alcohol. This species is known to have a vitellaria larva (Brooks and Grave, 1899).

Ophioderma cinereum Müller and Troschel

Ophioderma cinereum Müller and Troschel, 1842:87.—Ljungman, 1866:304; 1871:615.—Koehler, 1913:354.—H. L. Clark, 1915:301; 1918:337; 1919:57, 72; 1933:40, 71; 1942:379.—A. H. Clark, 1922:212; 1939a:452; 1954:377.—Boone, 1933:115–116, pls. 68, 69.—Engel, 1939:5, 9.—Caso, 1951:219, 221, 243, 249, figs. 11–14; 1953:215, 222; 1961:157–162, figs. 61–64.—Zeisenhenne, 1955:187, 192.—da Costa and da Costa, 1962:2.—Thomas, 1962b:65, fig. 1c.—Parslow and Clark, 1963:48.—Roa, 1967:295.—Tommasi, 1970:67.—Godcharles and Jaap, 1973:57.—Devaney, 1974:143.

Ophioderma antillarum Lütken, 1859:190, pl. 1: fig. 1a–c.

Ophiura cinerea.—Lyman, 1865:27.—Verrill, 1868:367.—Rathbun, 1879:150.—Ives, 1889:175; 1890:331 1891:339.—Stearns, 1891:iv.—Verrill, 1899a:6.—H. L. Clark, 1901:242.

Ophioderma cinerea.—Koehler, 1907:281; 1914:1, 6, 9, 147.—A. H. Clark, 1921:57.

Ophiocryptus hexacanthus H. L. Clark, 1915:64.

Material Deposited.—USNM E17856 (9 spec.)

Distribution.—Collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1) and just inside the reef crest (station 7).

Remarks.—Previously reported from Belize (Koehler, 1914:147), Turneffe Islands, Lighthouse Reef, and Glover's Reef (Devaney, 1974:143).

Ophioderma guttatum Lütken

Plate 5: *top right*

Ophioderma guttata Lütken, 1859:95, pl. 1: fig. 8a,b.

Ophiura guttata.—H. L. Clark, 1901:251.

Ophiura guttatum.—H. L. Clark, 1915:301; 1919:57, 72.

Ophioderma guttatum.—Ljungman, 1866:303.—H. L. Clark, 1933: 40, 72.—Ziesenhenne, 1955:186, 189.—Thomas, 1962b:65, fig. 1a.—Zeiller, 1974:108 [color fig.].

Material Deposited.—USNM E17684 (2 spec.); USNM E17685 (1 spec.); USNM E17777 (1 spec.); USNM E17778 (1 spec.).

Distribution.—Five specimens collected by Kjell Sandved just inside the reef crest (station 7), and on the reef crest in the rubble of the coral berm (station 8).

Ophioderma phoenium H. L. Clark

Plate 5: *top right*

Ophioderma phoenium H. L. Clark, 1918:333, pl. 6: figs. 1, 2; 1919:57, 72, pl. 3: fig. 1; 1933:40, 71.—Ziesenhenne, 1955:187, 192.—Devaney, 1974:144.

Material Deposited.—USNM E17690 (1 spec.); USNM E17776 (1 spec.); USNM E17781 (1 spec.).

Distribution.—Three specimens collected on the reef crest in the rubble of the coral berm (station 8).

Remarks.—Previously reported from Lighthouse Reef (Devaney, 1974:144).

Ophioderma rubicundum Lütken

Figure 178*b*; Plate 5: *top right*

Ophioderma rubicumdum Lütken, 1856a:8; 1859:192, pl. 1: fig. 2a–c.—Ljungman, 1866:304.—H. L. Clark, 1915:302; 1919:57, 72; 1933:40, 71.—A. H. Clark, 1922:213; 1939a:452; 1954:377.—Ziesenhenne, 1955:187, 197.—Roa, 1967:295.—Devaney, 1974:144.

Ophiura rubicunda.—Verrill, 1899a:6.—H. L. Clark, 1901:242.
Ophioderma rubicunda.—Koehler, 1907:282; 1914:1, 7, 148.—A. H. Clark, 1921:57.

MATERIAL DEPOSITED.—USNM E17683 (1 spec.); USNM E17687 (2 spec.).

DISTRIBUTION.—Collected by Kjell Sandved just inside the reef crest (station 7) and on the reef crest in the rubble of the coral berm (station 8). Collected in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of water (station 10), from the outer ridge of the outer fore reef (station 12), and from the fore-reef slope at 26 to 28 m (station 13).

REMARKS.—Previously reported from Lighthouse Reef and Glover's Reef (Devaney, 1974: 144).

Ophioderma squamosissimum Lütken

Ophioderma squamosissimum Lütken, 1856a:8; 1859:92, pl. 1: fig. 7a,b.—Ljungman, 1866:304; 1871:615.—H. L. Clark, 1915:302; 1918:335, pl. 4: fig. 1, pl. 6: figs. 3, 4; 1919:57, 69, 72, pl. 3: fig. 2; 1933:72.—Ziesenhenne, 1955:187, 189.—Thomas, 1962b:62, fig. 1b.—Parslow and Clark, 1963:27.—Godcharles and Jaap, 1973:57.—Zeiller, 1974: 108 [color fig.].

MATERIAL DEPOSITED.—CBC 75.5.15-1 (1 spec.); CBC 75.5.24 (1 spec.) (not catalogued).

DISTRIBUTION.—Found inside the sponge *Pseudoceratina crassa* (Hyatt) collected by K. Rützler on the inner-reef slope near station 11, 20 m (15 May 1975); also found by B. Spracklin on a lagoon patch reef, 1 km WSW of Carrie Bow Cay, 4 m (24 May 1975).

REMARKS.—Specimen CBC 75.5.15-1 has a disc diameter of 7 mm and an arm length of approximately 26 mm measured from the edge of the disc. The upper arm plates form five rows. The radial shields are exposed and consist of well-formed single plates. The sixth arm segment is just outside the margin of the disc and bears five spines on the side arm plates. The oral shields are exposed. There are no supplementary oral shields. The adoral shields carry a few large granules. A translucent gelantinous cuticle coats the entire exterior including spines, granules and oral papillae. The color in alcohol is white.

Specimen CBC 75.5.24 has a disc diameter of 35 to 38 mm. The arms are approximately 7 mm thick at the edge of the disc. Arm length from the edge of the disc is roughly approximated as 135 mm. There is no noticeable gelatinous cuticle. Supplementary oral shields present distal to the oral shields. Upper arm plates form seven rows. There are six spines on the ninth arm segment just outside the disc. The adoral shields are concealed by the oral shields. There are no single conspicuous plates readily identifiable as radial shields; instead, a large number of small plates bordered by granules occur in the general area of the arm bases and on the aboral interradial peripheral half of the disc. The central area of the aboral disc and the oral interradial areas are completely covered by granules similar to those present in *Ophioderma guttatum.*

Ophioderma species

FIGURE 179

MATERIAL DEPOSITED.—USNM E17788 (1 spec.); USNM E17789 (1 spec.).

DISTRIBUTION.—USNM E17788 collected on the reef flat under rocks in the north *Penicillus* zone (station 4); USNM E17789 on the reef flat under rocks in the south *Penicillus* zone (station 5).

REMARKS.—USNM E17788 has 15.8 mm disc diameter; upper arm plates entire; adoral shields bare; three small radial shields bare; 10 and 11 blunt-tipped arm spines on arm segments eight through 16, lowermost arm spine longest.

Although the specimen keys to *Ophioderma rubicundum* following Ziesenhenne (1955), it compares more favorably with *O. appressum* in total morphology and habitat. The color is mottled greenish brown and, as also found by Devaney (1974) at Lighthouse Reef and Glover's Reef, almost all *O. appressum* at Carrie Bow Cay have adoral shields free of granules. The absence of granules on three radial shields leaves identification problematic.

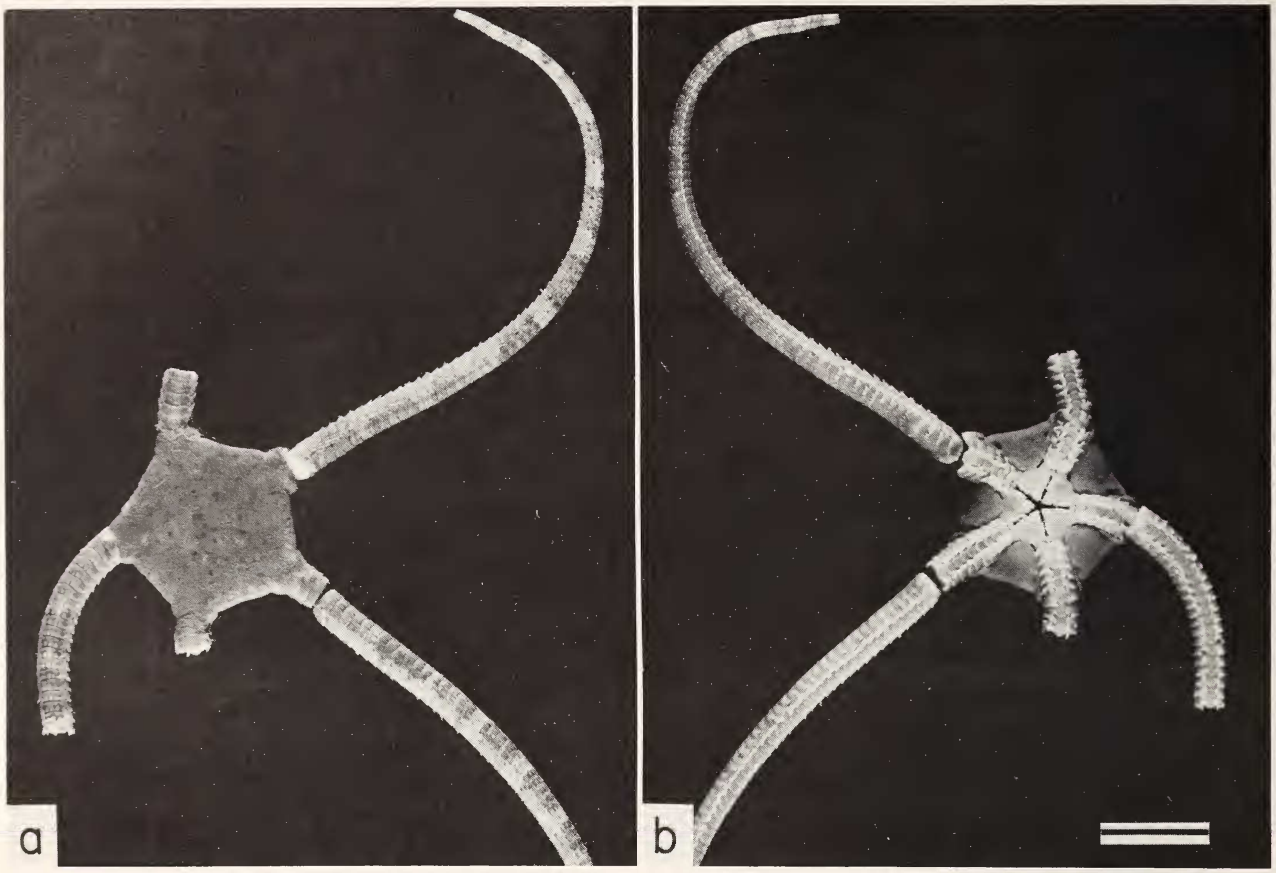

FIGURE 179.—*Ophioderma* sp., USNM E17788, dry. (Scale = 10 mm.)

USNM E17789 agrees in all respects with the above except that all radial shields are covered by granules.

Ophioderma species, juvenile

FIGURE 180

MATERIAL DEPOSITED.—USNM E17686 (1 spec.).

DISTRIBUTION.—Collected on the reef flat in the rubble of the coral-head/coral-pavement zone (station 6).

REMARKS.—Disc diameter 3.2 mm; upper arm plates entire; radial shields and adoral shields covered by granules; disc granules do not extend onto any part of the arms; arm spines five, less than half an arm segment long, conical, sharply pointed, of equal length; arm tips flattened.

The arm spines resemble those of both *O. brevicaudum* and *O. brevispinum*. The former, however, has relatively shorter arm segments and is said to pass through an *Ophiocryptus* stage with granules on the arms (A. H. Clark, 1939a); the latter has adoral shields free of granules. The upper surface of the disc is red with a central white spot, the lower surface white, and the arms banded red and white. Identification is problematic.

Ophiurochaeta littoralis (Koehler)

Ophiolimna littoralis Koehler, 1913:370, pl. 21: figs. 1–3; 1914: 3, 96, 111.

Ophiotreta littoralis.—H. L. Clark, 1915:216; 1919:56; 1933: 34, 43.—A. H. Clark, 1954:377.—Parslow and Clark, 1963:26.

Ophiurochaeta littoralis.—Matsumoto, 1917:316–317.—Devaney, 1974:147, figs. 10–12.

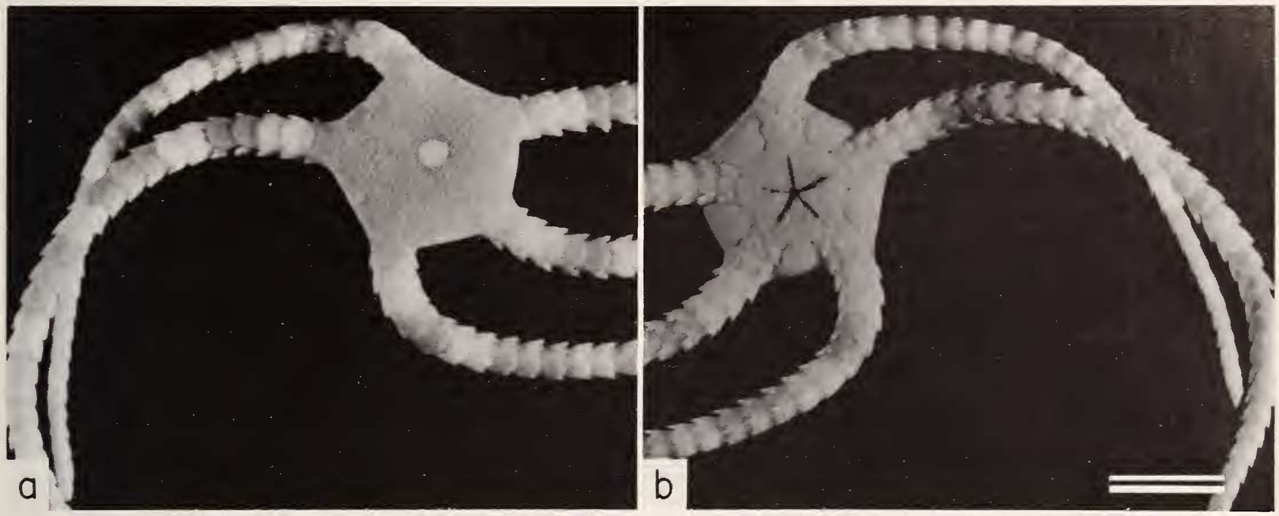

FIGURE 180.—*Ophioderma* sp., juvenile, USNM E17686, dry. (Scale = 2 mm.)

MATERIAL DEPOSITED.—USNM E17795 (1 spec.); USNM E17806 (1 spec.); USNM E17810 (1 spec.).

DISTRIBUTION.—Collected in the spur and groove zone of the inner fore reef from a coral bulk sample taken in 10 to 12 m of water (station 10), and from the fore-reef slope in 26 and 28 meters of water (station 13).

REMARKS.—Presence of young in the bursa of specimen USNM E17795 suggests but does not prove viviparity. Previously reported from Lighthouse Reef and Glover's Reef (Devaney, 1974: 147).

Family OPHIURIDAE

Ophiolepis impressa Lütken

Ophiolepis impressa Lütken, 1859:203, pl. 2: fig. 3a,b.—Ljungman, 1866:306.—Devaney, 1974:154, figs. 13–15.

Ophiozona impressa.—Lyman, 1865:64.—Verrill, 1899a:8.—H. L. Clark, 1901:242; 1915:337; 1919:57, 72; 1933:41, 73.—Koehler, 1907:289; 1914:2, 11, 150.—Matsumoto, 1915:82; 1917:298, 389.—A. H. Clark, 1921:57; 1922:213; 1939a:452; 1954:378.—Engel, 1939:5.—Fell, 1960:33.—Roa, 1967:296.—Tommasi, 1970:74.

MATERIAL DEPOSITED.—USNM E17848 (2 spec.); USNM E17852 (3 spec.).

DISTRIBUTION.—Collected on the back reef in the patch-reef zone of the study transect (station 3); on the reef flat in the north and south *Penicillus* zones (stations 4 and 5), in the coral-head/coral-pavement zone (station 6); just inside the reef crest (station 7), and on the reef crest in the rubble of the coral berm (station 8). One small specimen was extracted from a bulk sample from the outer ridge of the outer fore reef (station 12).

REMARKS.—Previously reported from Lighthouse Reef and Glover's Reef (Devaney, 1974: 154).

Ophiolepis paucispina (Say)

Ophiura paucispina Say, 1825:149.

Ophiolepis paucispina.—Müller and Troschel, 1842:90.—Lütken, 1859:204–206, pl. 2: fig. 2a,b.—Lyman, 1865:55.—Ljungman, 1866:306; 1871:618.—Verrill, 1868:367; 1899b:373.—Rathbun, 1879:151.—H. L. Clark, 1901:251; 1915:343; 1919:57, 72; 1933:41, 74; 1942:379.—Koehler, 1907:287; 1913:355; 1914:2, 11, 149.—A. H. Clark, 1921: 32, 44, 50, 58, 62; 1939a:452; 1954:378.—Engel, 1939:5, 9.—Fontaine, 1953:205.—Parslow and Clark 1963:48.—Tommasi, 1970:73, 92.—Devaney, 1974:155.

MATERIAL DEPOSITED.—USNM E17740 (1 spec.); USNM E17760 (8 spec.).

DISTRIBUTION.—Twenty-nine specimens collected among the discarded conch shells at the foot of the pier on the lagoon side of Carrie Bow Cay (station 1).

REMARKS.—The presence of arm tips of miniature young protruding through the genital slits in three deposited specimens probably indicates that this species is viviparous. Collected by Devaney (1974:155) at Lighthouse Reef.

Conclusions

The following species are reported for the first time from Belize: *Astrophyton muricatum*, *Ophiomitrella glabra*, *Sigsbeia murrhina*, *Amphiura fibulata*, *A. stimpsonii*, *Axiognathus squamatus*, *Ophiostigma* sp. (undescribed), *Ophiactis algicola*, *Ophionereis squamulosa*, *Ophiocomella ophiactoides*, *Ophiopsila riisei*, *Ophioderma anitae*, new species, *O. brevispinum*, *O. guttatum*, *O. squamosissimum*. Only *Ophioderma anitae* and *Ophiocoma paucigranulata* can at this time be considered possibly endemic to this part of the Gulf of Honduras. The fauna is otherwise widely distributed throughout the Greater and Lesser Antilles (Parslow and Clark, 1963), as might be expected from the general westerly flow of water through the Carribean (Duncan et al., 1977; Metcalf et al., 1977).

Although many species are found in all the major physiographic parts of the reef, nevertheless the rank-order distributions show certain qualitative and quantitative trends from lagoon to fore reef. Table 29 is an attempt to characterize the composition and facies of the ophiuroid fauna present in four main physiographic areas of the reef. The distribution of individual species over the study area has been given in the preceding systematic section. Because no quantitative sampling was undertaken, the actual numbers of specimens of any species collected are not meaningful. Very common species were not collected on every encounter, and the discovery of a previously unrepresented species usually initiated an attempt to secure additional specimens. It appears, however, that this distortion of actual and relative abundances has not greatly upset the rank order of abundances. My subjective impres-

TABLE 29.—Rank-order abundances of ophiuroids within major physiographic areas near Carrie Bow Cay (station numbers in parentheses, species arranged in each column in decreasing order of abundance, vertical bars connect species represented equally)

Lagoon (1, 2)	Reef flat, back reef (3–7)	Reef crest (8, 9)	Fore reef (10–13)
Ophiothrix oerstedi	*Ophioderma appressum*	*Ophiocoma wendti*	*Ophiocoma pumila*
Ophiactis savignyi	*Ophiocoma echinata*	*Ophiocoma paucigranulata*	*Ophiothrix angulata*
Ophiothrix angulata	*Ophiolepis impressa*	*Ophiocoma pumila*	*Ophioderma rubicundum*
Ophiolepis paucispina	*Ophiocoma wendti*	*Ophiocoma echinata*	*Ophiurochaeta littoralis*
Ophiocoma pumila	*Ophiocoma pumila*	*Ophioderma appressum*	*Ophiopsila riisei*
Ophiocomella ophiactoides	*Ophioderma rubicundum*	*Ophioderma anitae*	*Ophiactis savignyi*
Axiognathus squamatus	*Ophiomyxa flaccida*	*Ophiothrix oerstedi*	│ *Ophiothrix suensoni*
Amphiura stimpsonii	*Ophioderma brevicaudum*	*Ophiolepis impressa*	│ *Ophiothrix oerstedi*
│ *Ophionereis reticulata*	*Ophiothrix oerstedi*	*Ophioderma phoenium*	*Sigsbeia murrhina*
│ *Ophioderma cinereum*	*Ophionereis squamulosa*	│ *Ophioderma guttatum*	*Amphiura stimpsonii*
│ *Ophiocoma echinata*	*Ophiocomella ophiactoides*	│ *Ophiomyxa flaccida*	*Ophiocoma echinata*
Ophiostigma sp.	│ *Ophionereis reticulata*	│ *Ophioderma rubicundum*	*Ophiocoma wendti*
Ophiocoma wendti	│ *Ophioderma cinereum*	│ *Ophiomitrella glabra*	│ *Ophionereis reticulata*
Amphiura fibulata	│ *Ophioderma guttatum*	│ *Ophioderma brevicaudum*	│ *Ophiostigma* sp.
Ophioderma appressum	│ *Ophiactis savignyi*		│ *Astrophyton muricatum*
Ophionereis squamulosa	*Ophioderma* sp.		│ *Ophiomyxa flaccida*
	│ *Ophiothrix angulata*		│ *Ophiomitrella glabra*
	│ *Ophioderma brevispinum*		│ *Ophiocoma paucigranulata*
	│ *Ophioderma* sp., juv.		│ *Ophiolepis impressa*
			│ *Ophiactis algicola*
			│ *Ophionereis squamulosa*
			│ *Ophioderma squamosissimum*

sion is that the most common species in the field are the most common in the collection (and conversely for the least common), but Table 29 should only be considered an approximation for a number of reasons. Subjective field impressions involve psychometric aspects such as size and visibility which may only partly correlate with actual numbers of individuals. Certain species may be very adept at escaping collection with the hand methods employed. Although these results should be used with caution, they seem worth presenting, because I have not found any other attempts at rank ordering the species of ophiuroids by general habitat for the West Indian region. Species are listed in the table in decreasing level of abundance, with a vertical bar connecting those equally represented by numbers of specimens in the collection.

The ophiuroids found among discarded conch shells on the lagoon side of the island (station 1) are mainly small or minute species. It is notable that of the minute species three are fissiparous (*Ophiactis savignyi*, *Ophiocomella ophiactoides*, and *Ophiostigma* sp.) and two (probably three) are viviparous (*Axiognathus squamatus*, *Amphiura stimpsonii*, and *Ophiolepis paucispina*). The species of ophiuroids found on the reef flat (stations 4–6), including those from the inner reef crest zone (station 7), and the patch reef zone (station 3) are dominated by the families Ophiodermatidae, Ophiocomidae and Ophiuridae and the principal habitat is beneath coral, coral rock, or dead shells. The species of ophiuroids found on the reef crest, principally in the rubble of the coral berm (station 8), but also just seaward (station 9), are dominated by the families Ophiocomidae and Ophiodermatidae. It is likely that *Ophiocoma paucigranulata* is significantly overrepresented in the reef crest collection because once discovered, it was deliberately sought. The species of ophiuroids found on the fore reef—the spur and groove zone (station 10), the trough (station 11), the outer ridge (station 12), and also the accessible part of the fore reef slope (station 13)—are notable for the strong representation of epizootic species not found shallower, especially *Astrophyton muricatum*, *Sigsbeia murrhina*, *Ophiothrix suensoni*, *Ophiopsila riisei*, and *Ophiurochaeta littoralis*. Still, there is sufficient crevice habitat to support the presence of species of *Ophiocoma*, *Ophionereis*, and *Ophiolepis*, which are found principally under coral rock in shallower water.

Although the reproductive biology of the ophiuroids of Carrie Bow Cay needs further extensive investigation, the discovery of young in the bursae of *Ophiurochaeta littoralis* and *Ophiolepis paucispina* and the confirmation of fissiparity in West Indian *Ophiostigma* deserve comment at this time. The presence of young in genital bursae suggests but does not prove that these ophiuroids are viviparous. The counter example was provided by Smith (1938) in the case of *Ophiothrix fragilis*, which has a planktotrophic ophiopluteus larva. Smith found very young post larvae clinging to the oral interbrachial arm spines and slightly older post larvae present in the bursae of a small percentage of the adult population. Similarly, A. H. Clark (1939a) found young post larvae comparably located on the spines of *Ophiothrix hartfordi* from Puerto Rico. The young post larvae of *Ophiurochaeta littoralis* and *Ophiolepis paucispina* may somehow preferentially settle from the plankton onto the adults, but the mechanism for such action is difficult to identify. The subsequent presence of young post larvae in bursae may be interpreted (in accord with Smith) as the result of crevice-seeking behavior.

This possible strategy seems less applicable to *Ophiolepis paucispina* than to *Ophiurochaeta littoralis* because a relatively large proportion of the ophiuroids comparable in size with *O. paucispina* in the habitat of discarded conch shells practice direct recruitment through either viviparity or fissiparity, as noted above. This aspect of the minute ophiuroids of this habitat is highlighted not only by the possibility that *O. paucispina* is viviparous, but also by the presence of exclusively fissiparous specimens of *Ophiostigma* sp. A. M. Clark (1967a) did not include *Ophiostigma* in her list of fissiparous ophiuroids, presumably because she tentatively referred the fissiparous specimen of *Ophiostigma* recorded by H. L. Clark (1942) from

Bermuda to *Ophiocomella ophiactoides* (see Parslow and Clark, 1963). In my opinion, however, the generic identity of the present fissiparous specimens is certain, although they seem to represent an undescribed species rather than *Ophiostigma isacanthum.*

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